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PATENT ABSTRACTS OF JAPAN

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(54) PRODUCTION OF HIGH-STRENGTH CU ALLOY SHEET BAR

(57)Abstract:
PURPOSE: To produce the high-strength Cu alloy sheet bar having particularly excellent bending workability.
CONSTITUTION: A Cu alloy cast billed having a compsn. contg. 2 to 5% Ni, 0.3 to 1% Si, 0.1 to 2% Zn, 0.001 to 0.05% Mg and 0.05 to 1% Sn, and the balance Cu with inevitable impurities and contg. sulfur (S) and carbon (C) as the inevitable impurities each in a content of ≤20ppm and ≤ 20ppm is subjected to hot rolling, then to rapid cooling by water cooling and surface machining. In succession, the Cu alloy cast billet is repetitively subjected to colt rolling and annealing and is then subjected to cold rolling prior to finishing, then to a finishing treatment. This finishing treatment is executed by subjecting the billet to a soln. heat treatment, then to a primary aging treatment and is then subjected to a secondary aging treatment after finish cold rolling. This secondary aging treatment is executed at a temp. relatively higher than the primary aging treatment.

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CLAIMS

[Claim(s)]
[Claim 1] By weight %, nickel:2-5%, Si:0.3-1%, Zn:0.1-2%, Contain Mg:0.001-0.05% and Sn:0.05-1%, and the remainder consists of Cu and an unescapable impurity. And it is S:20 ppm about the content of sulfur (S) and carbon (C) as an unescapable impurity, respectively. Following, C:20 ppm In the manufacturing method of Cu alloy ****** which performs finishing processing succeedingly after repeating and giving cold rolling and annealing after quenching after hot-rolling Cu alloy ingot which has the composition made into the following and carrying out facing, and performing cold rolling before finishing It is the manufacturing method of high intensity Cu alloy ****** which the above-mentioned finishing processing consists of a process which gives a primary aging treatment after carrying out solution treatment, and gives a secondary aging treatment after finishing subsequently and cold-rolling, and is characterized by performing the above-mentioned secondary aging treatment at high temperature more relatively than a primary aging treatment.
[Claim 2] After holding the solution treatment in the above-mentioned finishing processing at 700-900 degrees C for 5 seconds to 60 minutes, it is performed on condition that quenching. a primary aging treatment It carries out on condition that maintenance at 300-600 degrees C for 0.5 to 12 hours, and finishing cold rolling is performed in rate:of rolling5-35%. a secondary aging treatment It is the manufacturing method of high intensity Cu alloy ****** according to claim 1 characterized by carrying out on condition that maintenance at 350-650 degrees C for 0.01 to 600 minutes, and performing a secondary aging treatment at high temperature more relatively than a primary aging treatment.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the manufacturing method of high intensity Cu alloy ****** (a board and **) for forming the electric electronic parts which excelled before in bending nature further, for example, a connector, a leadframe, etc.
[0002]
[Description of the Prior Art] Since intensity and conductivity are combined, Cu alloy of an Cu-nickel-Si system has been used as electric electronic-parts material, such as a connector and a leadframe, for many years. The manufacturing process of this Cu-nickel-Si system Cu alloy ******, A process, the rate of rolling repeat cold rolling and annealing succeedingly, quench an ingot with water cooling after hot rolling, and it generally carries out facing, become from the process which performs finishing processing after performing cold rolling before finishing, and the above-mentioned finishing processing carries out solution treatment at 650-900 degrees C: The bird clapper is known from about 15 - 75% of process finished and cold-rolled, and the process which carries out an aging treatment at 350-550 degrees C (refer to JP,5-59505,A).
[0003]
[Problem(s) to be Solved by the Invention] Extreme bending is needed in order to create electric electronic parts, such as this small connector, leadframe, etc., in recent years. However, when extreme bending was performed using Cu-nickel-Si system Cu alloy ****** manufactured by the above-mentioned conventional manufacturing process and electric electronic parts, such as a small connector and a leadframe, were created, the technical problem of a crack occurring was in the extreme bending portion.
[0004]
[Means for Solving the Problem] Then, this invention person etc., without spoiling properties, such as conductivity, tensile strength, and elongation The result which inquired to obtain high intensity Cu alloy ****** excellent in the bending nature which a crack generates even if it performs extreme bending, and which is not things, Quench Cu alloy ingot with water cooling after hot rolling, it carries out facing, and solution treatment of the ****** which performed cold rolling before finishing rolling after repeating cold rolling and annealing succeedingly is carried out. After giving a primary aging treatment, when finishing cold rolling was performed and the secondary aging treatment was given at temperature higher subsequently than primary aging-treatment temperature, the knowledge that Cu alloy ****** which was excellent in bending nature conventionally was obtained was acquired.
[0005] This invention is made based on this knowledge. by the weight nickel:2-5%, Si: 0.3-1%, Zn:0.1-1%, Mg:0.001-0.05%, Contain Sn:0.05-1% and the remainder consists of Cu and an unescapable impurity. And it is S:20 ppm about the sulfur (S) as an unescapable impurity, and a carbonaceous (C) content, respectively. Following, C:20 ppm Cu alloy ingot which has the composition made into the following is quenched with water cooling after hot rolling. In the manufacturing method of high intensity Cu alloy ****** which carries out facing, performs cold rolling before finishing after repeating and giving cold rolling and annealing succeedingly, and subsequently performs finishing processing the above-mentioned finishing processing An after

primary aging treatment is carried out, after [which carried out solution treatment] finishing subsequently and cold-rolling, a secondary aging treatment is given, and the above-mentioned secondary aging treatment has the feature in the manufacturing method of high intensity Cu alloy ****** performed at high temperature more relatively than a primary aging treatment.
[0006] As for the solution treatment in the above-mentioned finishing processing, it is desirable to carry out on condition that quenching after maintenance for 5 seconds - 60 minutes at 700-900 degrees C. Although it is desirable to perform finishing cold rolling in 5 - 35% of range, it is desirable to carry out on condition that maintenance at 350-650 degrees C for 0.01 to 600 minutes as for a secondary aging treatment and these conditions are included within the limits of the manufacture conditions of the conventional Cu-nickel-Si system Cu alloy In the manufacturing method of high intensity Cu alloy ****** of this invention It is characterized by performing more relatively than a secondary aging treatment finishing with dissolution object-ized processing and inserting the primary aging treatment of the conditions of maintenance at 300-600 degrees C between cold rolling processes for 0.5 to 12 hours, and the above-mentioned primary aging treatment with the degree of low temperature.
[0007] The reason which limited component composition of Cu alloy used by the manufacturing method of this invention is as follows.
[0008] (a) nickel and Si -- both [these] components are unitedly distributed minutely on a base -- Although it has the operation which a subject forms and has the intermetallic compound which consists of nickel2 Si, and raises intensity The improvement effect in on the strength of a request of the content less than [nickel:2%] and less than [Si:0.3%] is not acquired. Since conductivity came to have fallen on the other hand when the content of nickel exceeded 5%, and hot-working nature came to have fallen when the content of Si exceeded 1%, the content was determined as nickel:2-5% and Si:0.3-1%, respectively.
[0009] (b) although the ZnZn component had the operation which raises the heat-resistant detachability of solder, the effect of a request [at less than 0.1%] of the content to the aforementioned operation was not acquired, but since conductivity came to have fallen rapidly when the content exceeded 2% on the other hand, the content was determined as 0.1 - 2%
[0010] (c) although the MgMg component had the operation which raises hot-working nature, the hot-working disposition top effect of a request of the content at less than 0.001% was not acquired, but since no much more improvement effect showed up and there was even if the content exceeded 0.05% on the other hand, the content was determined as 0.001 - 0.05%
[0011] (d) although the SnSn component had the operation which raises adhesion intensity with the epoxy resin which are sealing agents, such as a semiconductor device, the improvement effect of a request [at less than 0.05%] of the content to the aforementioned operation was not acquired, but since conductivity came to have fallen when the content exceeded 1% on the other hand, the content was determined as 0.05 - 1%
[0012] (e) S as an unescapable impurity, and general C -- this kind of Cu alloy -- as an unescapable impurity -- S and C -- respectively -- 30 ppm although contained below -- these contents of S and C -- respectively -- 20 ppm the content of these S and C since the improvement effect in adhesion on the strength of the request by the above-mentioned Sn is not acquired unless it makes it below -- respectively -- 20 ppm You have to restrict to below.
[0013] Although quench with water cooling after hot rolling, facing is carried out, cold rolling and annealing are repeated and a finishing total-pressure total is carried out like the conventional manufacture method in the manufacture method of this invention after obtaining Cu alloy meeting of the above-mentioned component composition, the reason for condition limitation of each processing which exists in the feature for giving the following finishing processings succeedingly, and is included in this finishing processing is as follows.
[0014] (f) Although it is the processing performed to the well which suppresses the deposit of a solution treatment nickel silicide as much as possible, and avoids big and rough-ization of a recrystallization grain, and it carries out as short-time maintenance is carried out for a long time, when processing temperature is high when processing temperature is low Since dissolution-izing of nickel silicide is inadequate even if it holds less than 5 seconds at the

temperature to which nickel silicide more than ****** turns big and rough, and exceeds 950 degrees C on the other hand preferably even if it holds exceeding 60 minutes at less than 700 degrees C, it is not desirable. Therefore, solution treatment conditions were set to 700–950 degrees C for 5 seconds – 60 minutes at maintenance.

[0015] (g) If nickel silicide is deposited minutely and so much before finishing cold rolling and it cold–rolls by finishing where intensity is raised, after performing the primary aging–treatment above–mentioned solution treatment, suppressing the deposit of nickel silicide as much as possible and preventing big and rough–ization of a recrystallization grain, although bending nature will improve sharply Since effect sufficient on a bending disposition was not acquired whether it holds exceeding 12 hours at less than 300 degrees C in that case or held for less than 0.5 hours exceeding 600 degrees C and, primary aging–treatment conditions were set to 300–600 degrees C and 0.5 – 12–hour maintenance.

[0016] (h) although finishing cold rolling finishing cold rolling was carried out in order to heighten the effect of a secondary aging treatment further, when there were few effects of the improvement in on the strength of the rate of rolling at less than 5%, the rate of rolling exceeded 35% and a crack came to have occurred at the time of bending, the rate of rolling was defined to 5 – 35% from time

[0017] (i) Although it carried out in order to deposit a secondary aging–treatment nickel silicide minutely and to raise intensity, in order to raise especially bending nature, it set to 350–650 degrees C and the conditions for 0.01 – 600 minutes from the place where processing at high temperature relatively is more desirable than primary aging–treatment temperature.

[0018]

[Example]

Cu alloy which has the component composition (% of the weight) shown in example 1 table 1 was made into the ingot which had the size of thickness:150mm, width–of–face:500mm, and length:3000mm** by the semi–continuous casting method using the usual low frequency dielectric fusion furnace. It hot–rolled at the rolling start temperature of 950 degrees C to this ingot, and considered as the thickness:11mm hot–rolling board, and after water cooling, facing of the vertical side of the aforementioned hot–rolling board was carried out, and it could be thickness:10mm. The sheet metal of the thickness which repeats cold rolling, annealing, and pickling and is shown in Table 2 – 4 by the cold rolling before finishing in this was manufactured.

[0019] The sheet metal of the thickness shown in Table 2 – 4 which was cold–rolled before the above–mentioned finishing and obtained Immediately after [which carried out temperature x time maintenance] being shown in Table 2 – 4 within a salt bath furnace, water–cooled solution treatment is performed. The primary aging treatment of temperature x time shown in Table 2 – 4 by the clean heating furnace after grinding, pickling and is given, and after finishing and cold–rolling at the rate of rolling subsequently to Table 2 – 4 shown, the secondary aging treatment of the temperature x time maintenance succeedingly shown in Table 2 – 4 is given. this invention methods 1–20 and comparison methods 1–7 were enforced. Furthermore, the comparison method 8 which omitted the secondary aging treatment, and the conventional method 1 without a primary aging treatment were enforced. About Cu alloy sheet metal manufactured by these this invention methods 1–20, comparison methods 1–8, and the conventional method 1, tensile strength, elongation, bending nature, and conductivity were measured by the following method, and those measurement results were shown in Table 5 – 8.

[0020] (A) JIS which extracted tensile strength and the measurement sample of elongation at the rolling direction at parallel (BW shows to Table 5 – 8), and the right angle (GW shows to Table 5 – 8) No. 13 Tensile strength and elongation were measured using B test piece.

[0021] (B) Measurement JIS of conductivity It measured based on H0505.

[0022] (C) Measurement CES of bending nature Based on M0002–5, the value of inside bend–radius (R) / board thickness (t) parallel and when it makes it right–angled, it observes the central bending section of W–bending with a 75 times as many optical microscope as this and a crack occurs was measured for load:9807N, R:0–0.75mm (0.075mm multiple) of inside bend radii,

and the bending shaft to the rolling direction. Thus, bending nature is excellent, so that the value of measured R/t is small, and it is shown that bending nature is so bad that it is large.

[0023]

[Table 1]

Cu合金	成分組成（重量%）							
	Ni	Si	Zn	Sn	Mg	S	C	Cu
	3.51	0.76	0.37	0.23	0.013	0.0016	0.0008	残部

[0024]

[Table 2]

種別	仕上げ前冷間圧延による板厚（mm）	仕上げ処理条件			
		溶体化処理（温度×時間）	一次時効処理（温度×時間）	仕上げ厚さ0.15mmまでの仕上げ冷間圧延率（%）	二次時効処理（温度×時間）
本発明法 1	0.188	800℃×10秒	450℃×2時間	20	500℃×180分
2	0.177	750℃×30秒	430℃×3時間	15	450℃×180分
3	0.188	800℃×10秒	500℃×1時間	20	530℃×240分
4	0.167	850℃× 5秒	450℃×2時間	10	500℃×240分
5	0.177	780℃×40分	450℃×2時間	15	480℃×600分
6	0.167	700℃×20秒	450℃×2時間	10	500℃×120分
7	0.167	900℃×10秒	450℃×2時間	10	500℃×120分
8	0.167	800℃× 5分	300℃×2時間	10	480℃×0.5分
9	0.167	800℃× 5分	350℃×2時間	10	480℃×0.5分
10	0.177	800℃× 5分	500℃×2時間	10	580℃×0.1分

[0025]

[Table 3]

種別		仕上げ前冷間圧延による板厚 (mm)	仕上げ処理条件			
			溶体化処理 (温度×時間)	一次時効処理 (温度×時間)	仕上げ厚さ0.15mmまでの仕上げ冷間圧延率 (%)	二次時効処理 (温度×時間)
本発明法	11	0.167	800℃× 5分	550℃×2時間	10	580℃×0.1分
	12	0.158	850℃× 5秒	450℃×3時間	5	500℃×0.1分
	13	0.200	850℃× 5秒	450℃×3時間	25	500℃×0.1分
	14	0.214	850℃× 5秒	450℃×3時間	30	500℃×0.1分
	15	0.231	850℃× 5秒	450℃×3時間	35	500℃×0.1分
	16	0.176	800℃× 5分	450℃×3時間	15	470℃×0.2分
	17	0.176	800℃× 5分	450℃×3時間	15	500℃×0.2分
	18	0.176	800℃× 5分	450℃×3時間	15	520℃×0.2分
	19	0.176	800℃× 5分	450℃×3時間	15	550℃×0.2分
	20	0.176	800℃× 5分	450℃×3時間	15	570℃×0.2分

[0026]
[Table 4]

区別		仕上げ前冷間圧延による板厚 (mm)	仕上げ処理条件			
			溶体化処理 (温度×時間)	一次時効処理 (温度×時間)	仕上げ厚さ0.15mmまでの仕上げ冷間圧延率 (%)	二次時効処理 (温度×時間)
比較法	1	0.167	800℃ × 5分	250℃*×8時間	10	450℃×240分
	2	0.158	850℃ ×30秒	650℃*×3時間	5	400℃×180分
	3	0.155	900℃ ×10秒	500℃ ×2時間	3*	550℃×10分
	4	0.167	650℃*×10時間	450℃ ×3時間	10	550℃×10分
	5	0.188	950℃*×40分	450℃ ×2時間	20	500℃×1分
	6	0.176	700℃× 1時間	450℃× 2時間	30	400℃*×1分
	7	0.167	750℃×30分	450℃× 2時間	15	200℃*×240分
	8	0.250	850℃× 5秒	450℃× 2時間	40	-*
従来法 1		0.250	850℃× 5秒	-*	40	450℃×180分

*印は、この発明の条件から外れた値を示す。

<EMI ID=000004 HE=170 WI=122 LX=0440 LY=0300>. [0027]
[Table 5]

種別		1），2）試料の採取方向	Cu合金薄板の特性			
			引張り強さ（N／mm^2）	伸び（%）	3），4）曲げ加工性（R／t）	導電率（%IACS）
本発明法	1	GW	830	6	1	40
		BW	810	6	1	
	2	GW	810	6	0.5	41
		BW	800	7	0.5	
	3	GW	850	8	1	39
		BW	820	9	1	
	4	GW	860	7	1	38
		BW	820	8	1	
	5	GW	840	7	1	39
		BW	810	8	1	
	6	GW	815	8	1	41
		BW	805	9	1	
	7	GW	840	6	1	38
		BW	815	6	1	
	8	GW	800	8	0.5	38
		BW	790	9	0.5	

[0028]
[Table 6]

種別		1)，2) 試料の採取方向	Cu合金薄板の特性			
			引張り強さ (N／mm^2)	伸び (%)	3)，4) 曲げ加工性 (R／t)	導電率 (%IACS)
本発明法	9	GW	807	8	0.5	41
		BW	795	9	0.5	
	10	GW	812	8	0.5	40
		BW	800	9	0.5	
	11	GW	810	9	0.5	41
		BW	800	10	0.5	
	12	GW	830	8	0.5	40
		BW	810	9	0.5	
	13	GW	860	6	1	38
		BW	820	6	1	
	14	GW	865	6	1	38
		BW	835	5	1.5	
	15	GW	870	5	1.5	38
		BW	860	5	1.5	
	16	GW	840	7	1	41
		BW	823	8	1	

[0029]
[Table 7]

種別		1），2）試料の採取方向	Cu合金薄板の特性			
			引張り強さ（N／mm^2）	伸び（%）	3），4）曲げ加工性（R／t）	導電率（%IACS）
本発明法	17	GW	840	8	1	41
		BW	820	9	1	
	18	GW	837	9	1	40
		BW	817	9	1	
	19	GW	830	9	1	40
		BW	815	9	1	
	20	GW	825	9	0.5	41
		BW	812	10	0.5	
比較法	1	GW	730	8	1	32
		BW	700	9	1	
	2	GW	770	9	1	42
		BW	740	10	1	
	3	GW	730	8	1	40
		BW	705	9	1	
	4	GW	650	8	1	45
		BW	630	9	1	

[0030]
[Table 8]

種別		1)，2) 試料の採取方向	Cu合金薄板の特性			
			引張り強さ (N/mm^2)	伸び (%)	3)，4) 曲げ加工性 (R/t)	導電率 (%IACS)
比較法	5	GW	850	5	2	32
		BW	820	5	2	
	6	GW	780	4	1.5	38
		BW	770	5	1.5	
	7	GW	800	5	1.5	37
		BW	780	6	1.5	
	8	GW	880	2	4	39
		BW	885	1	5	
従来法	1	GW	760	7	3.0	39
		BW	770	8	2.5	

1) GWは圧延方向に平行に採取した試料を示す。
2) BWは圧延方向に垂直に採取した試料を示す。
3) 曲げ加工性は曲げ軸が圧延方向に直角の場合GW、平行の場合BWとした。
4) Rは内側曲げ半径、tは板厚を示す。

[0031] Compared with Cu alloy sheet metal obtained by the conventional method 1 which the process of a solution treatment -> finishing cold rolling -> aging treatment finished Cu alloy sheet metal obtained from the contents shown in Table 2 - 8, and the result by this invention methods 1-20 which the process of a solution treatment -> primary aging-treatment -> finishing cold rolling -> secondary aging treatment finished, and were processed, and was processed, it turns out that all are excellent in bending nature. However, the comparison methods 1-7 finished and processed at the temperature and the rate of rolling from which it separated from the conditions of this invention even if it performed the same finishing processing, and the comparison method 8 which omitted the secondary aging treatment understand the value and bird clapper which are not desirable for at least one of tensile strength, elongation, bending nature, and conductivity.
[0032] The thickness:11mm hot-rolling board was produced for Cu alloy ingot from which the component composition shown in example 2 table 9 differs on the same conditions as an example 1, and after water cooling, facing of the vertical side of the aforementioned hot-rolling board was carried out, it was referred to as thickness:10mm, cold rolling, annealing, and pickling were repeated and performed to this, and the board was prepared a thickness:1.0mm finishing

total-pressure total by the finishing total-pressure total. Temperature after performing solution treatment of water cooling after temperature:800 degree C and 10 second maintenance to this finishing total-pressure total board: Perform rate:of rolling15% of finishing cold rolling to Cu alloy sheet metal which gave 450 degrees C and the primary aging treatment of 3-hour maintenance, and gave this primary aging treatment further, and subsequently give the secondary aging treatment of maintenance for temperature:500 degree C and 0.5 minutes. Thickness: 0.15mm Cu alloy sheet metal was produced, and this invention methods 21-23 and comparison methods 10-21 were enforced.

[0033] Tensile strength, elongation, bending nature, and conductivity were measured for Cu alloy sheet metal obtained with these inventing methods 21-23 and comparison methods 10-21 like the example 1, and those measurement results were shown in Table 10 and 11.
Furthermore, other properties were also shown in the remarks column of Table 10 and 11.

[0034]

[Table 9]

種別		Cu合金薄板の成分組成（重量%）							
		Ni	Si	Zn	Mg	Sn	S	C	Cu+不純物
本発明法	21	2.5	0.6	0.3	0.015	0.1	0.002	0.001	残
	22	3.0	0.7	0.5	0.010	0.2	0.001	0.001	残
	23	3.5	0.8	0.3	0.010	0.2	0.001	0.001	残
比較法	10	1.5*	0.4	0.4	0.007	0.3	0.002	0.001	残
	11	6.0*	1.5	0.3	0.009	0.2	0.001	0.001	残
	12	2.5	0.1*	0.3	0.009	0.2	0.001	0.001	残
	13	5.0	1.3*	0.3	0.012	0.3	0.002	0.002	残
	14	3.3	0.7	0.05*	0.013	0.2	0.001	0.002	残
	15	3.1	0.75	2.5*	0.009	0.2	0.001	0.002	残
	16	2.7	0.7	0.4	0.005*	0.4	0.002	0.001	残
	17	2.8	0.7	0.5	0.07*	0.4	0.002	0.001	残
	18	3.0	0.65	0.3	0.012	0.03*	0.002	0.002	残
	19	2.8	0.7	0.3	0.013	1.2*	0.001	0.001	残
	20	2.8	0.7	0.3	0.008	0.4	0.003*	0.002	残
	21	3.0	0.72	0.3	0.012	0.4	0.001	0.003*	残

（*印は、この発明の範囲から外れた値を示す。）

[0035]

[Table 10]

種別		1），2）試料の採取方向	Cu合金薄板の特性				
			引張り強さ（N／mm^2）	伸び（%）	3），4）曲げ加工性（R／t）	導電率（%IACS）	備考
本発明法	21	GW	810	6	1	45	—
		BW	800	6	1		
	22	GW	830	6	0.5	40	—
		BW	810	6	0.5		
	23	GW	850	6	0.5	36	—
		BW	820	7	0.5		
比較法	10	GW	720	5	1.0	52	—
		BW	700	6	1.0		
	11	GW	880	4	1.5	25	—
		BW	860	4	1.5		
	12	GW	700	8	1.0	38	—
		BW	680	7	1.0		
	13	GW	870	4	1.5	28	—
		BW	850	5	1.0		
	14	GW	830	6	1.0	38	ハンダ耐熱剥離性不良
		BW	810	6	1.0		

[0036]
[Table 11]

種別		1），2）試料の採取方向	Cu合金薄板の特性				備考
			引張り強さ（N／mm²）	伸び（%）	3），4）曲げ加工性（R／t）	導電率（%IACS）	
比較法	15	GW	850	5	1	25	−
		BW	820	6	1		
	16	GW	820	6	1	43	熱間加工性不良
		BW	800	6	1		
	17	GW	820	6	1	30	−
		BW	800	6	1		
	18	GW	840	5	1	41	樹脂との密着強度不良
		BW	810	6	1		
	19	GW	830	6	1	21	−
		BW	810	6	1		
	20	GW	820	6	1	40	熱間加工性不良
		BW	800	8	1		
	21	GW	830	6	1	39	熱間加工性不良
		BW	800	6	1		

1）GWは圧延方向に平行に採取した試料を示す。
2）BWは圧延方向に垂直に採取した試料を示す。
3）曲げ加工性は曲げ軸が圧延方向に直角の場合GW、平行の場合BWとした。
4）Rは内側曲げ半径、tは板厚を示す。

[0037] From the result shown in Table 9 − 11, as a raw material, nickel:2−5%, Si:0.3−1%, Zn:0.1−2%, Mg:0.001−0.05%, and Sn:0.05−1% are contained. The remainder consists of Cu and an unescapable impurity, and it is S:20 ppm about the sulfur (S) as an unescapable impurity, and a carbonaceous (C) content, respectively. The following and C:20 ppm This invention methods 21−23 using the Cu−nickel−Si system Cu alloy which has the composition made into the following. It turns out that all are excellent in a property compared with the comparison methods 10−21 from which obtained Cu alloy sheet metal has separated from the conditions of this invention.

[0038]

[Effect of the Invention] As mentioned above, it becomes possible to perform severe bending using Cu alloy ****** which could manufacture Cu alloy ****** which was excellent in bending nature, without degrading intensity and conductivity according to this invention, and was manufactured according to the manufacturing method of this invention, electric electronic parts, such as a still smaller connector and a leadframe, can be manufactured, and it can greatly contribute to development of industry.

[Translation done.]